

# AMATEUR SATELLITE REPORT

AMSAT® NA Newsletter for the Amateur Radio Space Program



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## **AO-13 Era Begins With Huge Entourage Waiting**

The AO-13 era began with a roar Friday, July 22, when perhaps thousands of satellite communicators welcomed the newest OSCAR to life. The satellite was first turned on for general communications operations at 1500 UTC, July 22.

The pre-announced operating schedule had to be modified since the satellite attitude had not reached the proper orientation by July 22. The modified schedule had Mode B only running from MA 56 to 210. Satellite controllers indicated maneuvering is slower than expected. This could be due to the higher perigee altitude or the higher inclination of the orbit or both, sources indicate.

Controllers suggest the satellite should be properly oriented in a few days. That will allow the full operating schedule, including Mode L to begin. Initial Mode L activation did take place on July 24 late in the day.

When turned on, the Mode B transponder was using its low gain (monopole) receive antenna on 70 cm and was transmitting on its high gain 2 meter array for the downlink. Use of the low gain uplink antenna was apparently mandated by the off-pointing of the satellite.

The use of the low gain uplink antenna imposed at least a 9 dB penalty in link performance on the uplink. The high gain 70 cm array, three phased dipoles over ground, has a gain of 9.5 dBic. The monopole gain is only about -2 dBic. Later, when the Mode B session ended, the 2 meter downlink reverted to the 2 meter monopole.

When the satellite is properly oriented, which will allow the use of the high gain arrays on both Mode B uplink and downlink, the performance should be quite remarkable.

The satellite operated on orbit 80 from 1500 UTC to about 1852 UTC (MA 210). Operations over Europe were reported moderate. Apparently word had not circulated widely in Europe that AO-13 was to be turned on that afternoon.

The next Mode B operation over the Western Hemisphere was anything but moderate. An army of operators numbering probably in the high hundreds or even thousands pounced on Mode B at exactly 2326 UTC. Among the swishing and ditting, virtually no one could find their downlink not to mention carry on a QSO.

If AO-13 wanted to know what it felt like to be pelted with rf from hundreds of 70 cm transmitters at once, its wish

was fulfilled at that instant. AO-13's 70 cm receiver AGC zoomed to 12 dB or more it was reported.

Fortunately, things got sorted out in an hour or two. By halfway through the nearly 7 hour Mode B episode, many friendly QSOs were under way between old friends who renewed past acquaintances put on hold since AO-10's decline.

Towards the end of the orbit 81 Mode B episode, in fact, operating conditions had improved so much that many were obliged to substantially reduce their uplink power to avoid embarrassingly loud downlinks. This was a far cry from the first few minutes of orbit 81 Mode B operations when a blanket of white noise cloaked the entire passband.

Operations on Saturday, July 23 were excellent with a healthy contingent populating the Mode B passband. Then, late on Sunday, July 24, satellite controllers began a series of experiments on Mode J, L, JL and RUDAK. Mode J use began about 2300 UTC July 24 followed by activation of the Mode L transponder. Several Mode L users reported initially poor but improving conditions. This was fully attributable to the off-pointing of the Mode L 24 cm receive antenna AMSAT said. WA3WBU, KØRZ and others reported the Mode L operating conditions did in fact improve later but then Mode L was switched off before any additional analysis could be made.

Many, no doubt, were discouraged by the unpleasant surprise which unfolded with the initial Mode B operation on Friday, July 22. These folks will be back when more "regular" operating conditions prevail as indeed seemed the case even towards the end of orbit 81. Mode B users running 10 watts barefoot were comfortably into the transponder late in the orbit.

What seemed most remarkable, many users said, was how well the satellite was performing late in the orbit even while under considerable load from many, many users and under the penalty of the low gain 70 cm receive antenna indicated by the PSK telemetry.

The outpouring of enthusiasm, despite the initial chaos was heartening according to AMSAT officials. It's plain, one said, we're tapping into a new and renewed user community that's bound to make AO-13 the most popular and productive OSCAR ever built!



## **"First Day Club" Operations An Outstanding Success Despite Crammed Band**

To celebrate the commencement of AO-13 operations July 22, AMSAT-NA sponsored an AO-13 "First Day Club" open to ALL satellite communicators and ALL listeners. Once the initial chaos and surge of would-be AO-13 users subsided, AMSAT-NA's "First Day Club" Special Event stations were able to log hundreds of stations. These stations then became eligible for their "First Day Club" awards.

"First Day Club" Special Event stations were operated from various locales by AMSAT veterans such as K8OCL, WA3WBU, K9NO, K7RIE, W8GQW, KL7GRF and VE7XQ. Together they logged several hundred stations throughout the Western Hemisphere.

Awards will be made in three classes of membership to the AO-13 "First Day Club":

**GOLD CLASS:** Requires successful two-way QSO with Official AMSAT "First Day Club" station plus CURRENT AMSAT membership. Gold Class "First Day Club" members will receive an historic, handsome AO-13 QSL card with special "First Day Club" endorsements plus a beautiful AMSAT AO-13 "First Day Club" certificate.

**SILVER CLASS:** Requires successful two-way QSO with Official AMSAT "First Day Club" station but not current AMSAT member. Silver Class "First Day Club" members receive the AO-13 QSL card with "First Day Club" endorsements only.

**BRONZE CLASS:** Requires successful monitoring of Official "First Day Club" station but not current AMSAT member. Bronze Class club members receive an AO-13 QSL card.

"First Day Club" operations on AO-13 ran from 23:30 thru 06:19 UTC and operated on 145.957 MHz for the Official station and between 145.935 and 145.955 MHz for participants.

Planning for the "First Day Club" special event was hobbled by the uncertainty in the exact "turn-on" day. AMSAT officials said they would have liked to have had more lead-time in planning the event but added the uncertainties experienced are fairly common in the transition of a system from engineering phase to operations phase. When it appeared the turn-on date coincided with the onset of a weekend and would be viewable in the target area, it was decided to go ahead even with the short lead-time.

To receive their award certificates and "First Day Club" QSLs, participants need to promptly send an SASE to: AMSAT, "First Day Club", P.O. Box 27, Washington, DC, 20044. Please indicate your callsign and your AMSAT member number, if any, in your letter. This is essential. Without the SASE and your call and member number, AMSAT will be unable to process your award. There is no charge for the award but donations to cover costs are always very much appreciated. Those who do not hold current membership and wish to be eligible for the Gold Class "First Day Club" award have a one week grace period, ending July 29, to get their membership current. Call 301-589-6062 for info.

## **Say Higher Perigee Altitude Slows AO-13 Attitude Maneuvers**

At press time, July 25, AMSAT-DL satellite controllers say AO-13 should have reached its proper attitude by today. The re-orientation from the second kick motor firing attitude had taken longer than expected. Several factors are at work here. The overriding fact is, however, that these types of maneuvers have never been done before under these circumstances and there are quite a number of unknowns that must be dealt with.

The attitude control mechanism on AO-13 consists of a group of subsystems which combine to steer the satellite. The sun and earth sensors locate and measure the position of these bodies. The IHU computes spacecraft attitude from these measurements and the magnetorquers, responding to IHU commands, generate magnetic fields. These fields interact with the geo-magnetic field to produce a torque to change the satellite's orientation in space.

The geo-magnetic field intensity falls off rapidly with altitude and also varies with latitude. Since AO-13 is at a much higher perigee than originally planned (2500 versus 1500 km), the geo-magnetic field is much less. Thus, the time required for torquing is much more. (The field drops off as the cube of the distance. Doubling the altitude reduces the field eight-fold).

Nevertheless, controllers are gaining experience in the existing orbit and are thus better able to predict the time required for a given maneuver. They now say all will be right (well-oriented) by about July 25. If this is achieved, the satellite will be nadir-pointing at apogee. That means that when at its highest point (apogee) the spacecraft's antennas will be pointing directly at earth's center. In the Bahn coordinate system, that will mean BLON (longitude) is 180 degrees and BLAT (latitude) is 0 degrees. (An explanation of Bahn coordinates appears in an upcoming Amateur Satellite Report.

The previously announced AO-13 operating schedule, subject to confirmation, is:

Mode	From	Thru	Duration MA Minutes
Off	MA 225	MA 29	61 163.7
Mode B	MA 30	MA 97	68 182.5
Mode L	MA 98	MA 157 (daily)	60 161.0
Mode JL	MA 98	MA 157 (weekends only)	60 161.0
Mode B	MA 158	MA 224	67 179.8
Mode S	(Mode-S operations will commence when sun angles permit; likely in September		
RUDAK	Concurrent with Mode L		

## **Final Steps Leading To Satellite Operations Detailed**

After years of delays caused by various launcher problems, the newest OSCAR is now safely ensconced in its final orbit and finally on the air. It reached its final orbital milestone shortly after the second and final kick motor firing on July 6.

After the final kick motor firing, several additional steps were taken towards checking out the various systems and



configuring the spacecraft for general operations which began July 22.

Immediately after firing the kick motor, an assessment of the spacecraft attitude and condition was made. The spacecraft apparently suffered no ill effects of the 5.5 minute burn and post-burn analysis of the orbit suggests the spacecraft attitude was nearly perfect at the instant of motor firing on July 6.

On July 11, the RUDAK CPU was switched on for the first in-orbit check. A complete verification of the 52 kbyte RUDAK memory was successfully performed according to AMSAT-DL. However, the RUDAK beacon activation (435 MHz downlink) had to await proper orientation of the spacecraft. A description of RUDAK appears in two installments in the July and August QST satellite communications column.

By Saturday, July 16, the satellite had been successfully spun down to 29 rpm which is close to the desired angular velocity.

As has been discussed in previous bulletins, orbital determination has proceeded extremely well with AO-13. The process has become a source of considerable pride with those who participated. According to G3RUH, tracking data based on various sources and processes have converged nicely. First, the estimated element set based on assumed motor performance and burn time; second, the element sets derived by active AMSAT ranging methods and third, the radar skin track-derived element sets have all converged to a remarkable degree says G3RUH. The satellite has been assigned catalog number 19216 and is being tracked by NORAD radar facilities.

Here is a recent element set which has provided excellent AO-13 tracking:

Satellite:	Oscar-13
Catalog number:	19216
Epoch time:	88193.90000000
Mon Jul 11 21:36:00.0 1988 UTC	
Element set:	mh7-12
Inclination:	57.6540 deg
RA of node:	247.5380 deg
Eccentricity:	0.6538919
Arg of perigee:	187.2210 deg
Mean anomaly:	357.2170 deg
Mean motion:	2.09697960 rev/day
Decay rate:	0 rev/day <sup>2</sup>
Epoch Rev:	57
Semi major axis:	25783.070 km
Anom period:	686.701959 min
Apogee:	36264.507 km
Perigee:	2545.826 km
Ref perigee:	3844.90368652
Mon Jul 11 21:41:18.515 1988 UTC	

Special AO-13 tracking data:  
Reference Perigee: 08Aug88 02:03:20 UTC @ 7.3S, 278.8W (81.2E) Orbit 115  
Longitude Increment: 187.81 deg East/orbit

## ZRO Test To Return On Modes B and L; SATFOX Soon

With AO-13 now up and running, many users are looking forward to the return of the popular ZRO-Memorial Station Engineering Award, a component of AMSAT's Technical Achievement Awards Program. The ZRO-Tests were suspended when AO-10 lost its attitude control capability. The competition ran on AO-10 for nearly two years ending in 1986.

The ZRO Test challenges individuals in an unusual way

for an Amateur Radio competition. It requires the participant to copy CW signals at progressively lower levels and awards certificates of merit to those who demonstrate superior receive sensitivity of their stations. In this way it provides an explicit benchmark for the station's owner. He'll know in absolute terms how well he's hearing and in relative terms how well he stacks up to other satellite users. In the AO-10 Mode B ZRO Test, the level attained by most participants was a Z-6 meaning they could hear a test signal 18 dB weaker than the beacon; quite an achievement. Some poor chaps could only hear 3 dB below the beacon! They got a certificate and some free advice!

The competition begins with a signal sent through the passband with a downlink amplitude equal to the beacon. That's the baseline or Z-0 level. The the downlink is reduced by 3 dB to become the Z-1 level. A series of CW numbers is sent at about 10 wpm. The participant logs the numbers. Then the level is reduced by another 3 dB for the Z-2 level; 6 dB below the beacon. More CW numbers are sent at lower and lower levels until at Z-8, the signal is a faint 24 dB below the beacon. While a few have copied the Mode L test at -24 dB and thus earned a coveted Mode L Z-8 rating, only one station has thus far earned a Mode B Z-8 (W7ID). AMSAT says plans call for commencing the ZRO tests on AO-13 in early Autumn.

The SATFOX Technical Achievement Award challenges the participant to locate a hidden "Fox" via satellite (AO-13) by measuring the Doppler shift of the emitter over a period of hours. Precision frequency measurements must be made and a complex analysis of the results is required. This competition is in the conceptual and development stage with mathematical and gaming studies under way now. A computer analysis program for participants is planned to reduce the computational burden. Nevertheless, the participant WILL be obliged to obtain and maintain high precision frequency standards and measurement tools and be knowledgeable in their use. That's where the skill comes in. First SATFOX experiments could be accomplished in late Autumn leading to first actual competition in early 1989.

Other special events are planned for AO-13. According to AMSAT President WA2LQQ, "We plan to sponsor an array of challenging, non-disruptive operating and technical events. We'd like to see one major event every two months or so; more if justified." AMSAT membership will be required to participate in these events WA2LQQ pointed out.

## ARRL Networking Conference

The 7th Annual ARRL Networking Conference will be held on Saturday, October 1 at the Johns Hopkins University Applied Physics Laboratory (APL) Kossiakoff Center. The APL facility is located between Laurel and Columbia MD, midway between Washington and Baltimore.

The networking conference will bring together the developers of hardware and software for amateur computer networks and users. In the past the conference has been a forum for announcement of many exciting developments. The published conference proceedings have become valuable reference documents. This year it is anticipated that contributions will include information on new networking software, new modem technology, digital signal processing and the new series of PACSAT satellites which



AMSAT-NA plans to launch beginning in early 1989.

Prospective contributors should obtain an author's kit direct from ARRL. The deadline for the submission of camera-ready manuscripts is August 25th.

If you plan to attend the conference, we ask that you register early. A registration fee of \$20 will provide a copy of the conference proceedings, buffet luncheon and defray the costs of putting on the meeting. If your registration is received after Sept. 25, the fee will be \$30.

Your registration should be sent directly to:

Don Bennett, K4NGC

P.O. Box 1944

Woodbridge, VA 22193

Make your checks payable to Don Bennett. Registrants will be sent a list of suggested hotels/motels in the area, maps, etc. Sponsors of the conference include the ARRL, APL ARC, AMSAT, TAPR, AMRAD and VPRA.

## Short Bursts

- AMSAT has launched a major fund-raising campaign to re-vitalize its depleted treasury for important future projects. Generous donations to AMSAT are urgently needed now if AMSAT is to continue to serve your needs. Please respond positively to this appeal. Your help is needed now.
- AMSAT has issued a Call For Papers for its Annual Space Symposium. Papers on topics relevant to the Amateur Space Program are solicited. Deadline for submission is September 10, 1988. The Symposium will be held in Atlanta this year on November 11-13. This is a preliminary announcement

only. Details to follow ASAP. Mail abstracts and/or papers to AMSAT, P.O. Box 27, Washington DC, 20044

- Mike Parisey, WD0GML, says he has now completed preparations and placed his new dial-up computer BBS in operation. According to Mike, it will be available full-time on 314-447-3003 and carry the latest AMSAT bulletins and orbital data. It will run the same BBS system used at the W0RPK system Mike says. Operating at 300 or 1200 baud at present, set your modem for even parity, 7-bit word with 1 stop bit full duplex. There is no charge for this service.
- Jeff Kelly, KT2K, operated what is claimed to be the first AO-13 gateway station on Mode B and Mode J on July 22 and July 24, respectively. Jeff linked the 220 MHz WA2VKH repeater in New Jersey through AO-13 with N2AAM at the controls. Numerous users using only 220 MHz HTs QSO'ed through the new bird. Details in a feature story in ASR #181.
- Having difficulty copying AO-13's RTTY telemetry? Are you getting letters instead of numbers for the telemetry values? If you're using one of the electronic RTTY boxes, chances are you've got it set for "downshift on space". Since "figs shift" is not sent with each new number group in the AO-13 telemetry, you'll need to disable the "downshift on space" function of your RTTY box to get good copy of the number groups. Thanks to WA3WBU and W4FJ for this tip.
- Here is the AO-10 operating schedule:

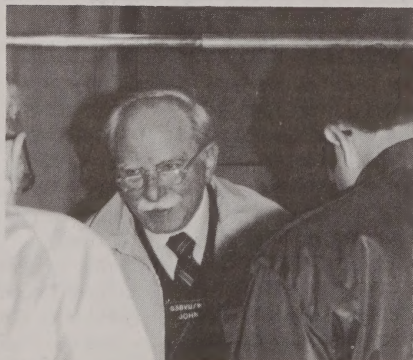
August 1 - August 15: Mode B MA 30 to MA 240

The satellite will be unavailable for use beginning August 16 because of predicted insufficient solar illumination and reduced battery charge.

## AMSAT® NA

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